Outreach Education: Making Neuroscience Readily Available for Rural Students and Communities of Alaska

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Abstract

WHAT is neuroscience? Neuroscience is the scientific study of the structure or function of the nervous system and brain. To get a grasp on the vast study of neuroscience, first think of the human body and how complex it is. Think of the skeletal system and the muscular, nervous, digestive and respiratory systems that make up the human body and keep it running in tip top shape. Now think of the brain, a singular organ of soft nervous tissue that one-handedly controls all of those other systems, including both mental and physical actions. Sounds a bit daunting doesn't it? That's where a great little company comes in, called Backyard Brains. Backyard Brains, founded by two grad students of the University of Michigan, is a company that strives to make the study of neuroscience more easily comprehensible and readily available to both students and educators. Not only did the founders of this company **want** to make neuroscience more accessible they actual **did!** With the invention of their first product, the SpikerBox, which uses invertebrates to help explain how the cells in the brain work to communicate with one another. Specifically speaking, the SpikerBox is a "bioamplifier" that allows the user to hear and see spikes, or action potentials

WHY is neuroscience important to understand? While the SpikerBox may only help us better understand neural activity in invertebrates, it opens the doors to and expands our knowledge of neural activity in humans. Understanding the neuroscience of humans is important because the more knowledge we can gain about the inner functioning's of the brain and connected nervous system the faster we can develop techniques and treatments for various diseases and injuries that may be impacting peoples lives.

So, now we know what neuroscience is and why it's important, but HOW do we administer this knowledge to students and educators in rural communities of Alaska? While Backyard Brains has done much of the heavy lifting on solving this problem, a crucial gap still remains between their products and experiments and students and educators living in areas without access to internet or other supplemental teaching aids. This is where the proposed SpikerBox Outreach Kit comes into play. This kit will contain everything a student or educator needs to help further spread the knowledge of neuroscience. Complete with a SpikerBox, an EMG (ElectroMyoGram) SpikerBox, lab manuals for various experiments, and any additional equipment students will be able to study neuroscience in almost any environment!

Sample Experiments That Demonstrate Neuroscience

A Beginners Experiment: Getting Started with the Spiker Box

Figure 1. Leg Removal

Procedure

1. Pick a specimen, crickets and cockroaches work best. Ice the chosen specimen until it is properly anesthetized.

2. Carefully cut off one of the specimens legs near the body as shown in Figure 1. Don't worry, crickets and cockroaches can grow their legs back!

3. Using the provided electrodes, place the leg on the cork of the SpikerBox with one electrode in the coxa and one in the femur.

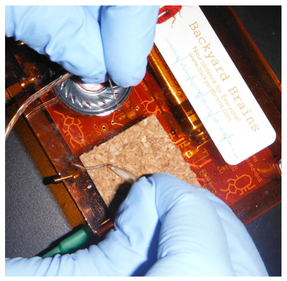


Figure 2. Electrode Placement

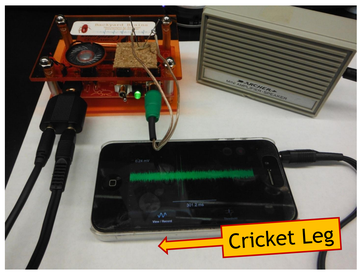


Figure 3. Experiment Setup

4. Connect the SpikerBox, a smartphone, a speaker, and accompanying cables together as shown in Figure 3. Turn on the SpikerBox and "Backyard Brains" oscilloscope app.

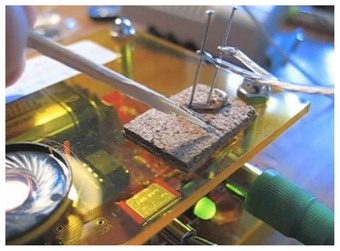


Figure 4. Cockroach leg responding to toothpick stimuli

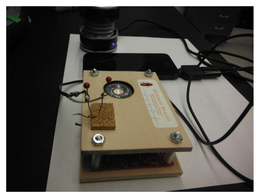
5. Watch the neuron spikes firing on the oscilloscope app as the specimens leg is touched or agitated.

While this experiment is very basic, Backyard Brains has come up with various other experiments that range in difficulty level. The greatest part is that each of these experiments, whether basic or advanced can be done right at home or within a rural school just by obtaining this neuroscience kit. With the help of Backyard Brains and such a kit, neuroscience and related topics can be taught to a wide range of students in a wide range of areas that otherwise would not have the means or opportunity to do so.

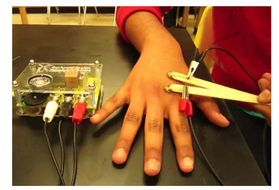
More Sample Experiments!

Advanced Experiments

Effect of Temperature on Neurons

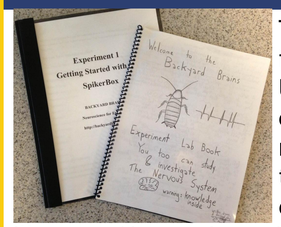


Microstimulation of Neurons and Muscles - an experiment that uses music, or frequency and amplitude, to excite nervous and muscle tissue.



EMG (ElectroMyoGram) SpikerBox - detect electrical activity in human muscles non-invasively.

Conclusions



The study of neuroscience has its very own important place in the world of science. Understanding the brain and nervous system contributes greatly to the discovery of new methods that can be used in the treatment of many different diseases and illnesses. Neuroscience is a very large and quickly growing field that would benefit greatly from widening its educational outreach. However, education in rural communities of Alaska can be a challenge when most bush villages are in a remote location without internet access. But with the help of Backyard Brains and a SpikerBox Outreach kit, students and educators all across the state will have the means to study neuroscience and participate in a hands on lab.

Figure 5. Mock SpikerBox Outreach Kit

References

Backyard Brains
http://backyardbrains.com/

Check them out !

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